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AUTHOR	Filer, Randall K.; Munich, Daniel
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ABSTRACT

This paper examines the post-Communist Czech Republic in order to investigate the possible consequences were a major U.S. state to adopt universal education vouchers. Although public schools in the Czech Republic were relatively good post-communism, there was an initial surge in demand for private alternatives. Private schools appear to have arisen in response to distinct market incentives. They are more common where public school inertia has resulted in an undersupply of available slots and where the public schools appear to be doing a worse job in their primary educational mission, as demonstrated by the success rate of academic high schools in obtaining admission to the top universities for their graduates. There is evidence that public schools facing private competition do improve their performance. They spend more of their resources on classroom instruction and significantly reduce class size. Evidence from the adoption of the Czech nationwide voucher scheme supports the claim of advocates for such systems. Private schools supported by vouchers increased educational opportunity and spurred public schools to improved performance. They also spurred public schools to engage in bureaucratic maneuvering designed to preserve their entrenched position. (Contains 11 tables and 43 references.) (SM)

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Responses of Private and Public Schools to Voucher Funding: The Czech Experience*

Randall K. Filer[1]
Daniel Münich[2]

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[1] Randall K. Filer is Professor of Economics at Hunter College and the Graduate Center, CUNY and CERGE-EI, Prague, a joint workplace of Charles University and the Academy of Sciences of the Czech Republic.
[2] Daniel Münich is Assistant Professor of Economics at CERGE-EI. Both are Research Associates of the William Davidson Institute of the University of Michigan.

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I. Introduction

Given reluctance to adopt major reforms without evidence that they would be successful, there have been few opportunities to test the theoretical assertions of advocates for educational vouchers (see Friedman and Friedman 1981). Key among these assertions are that, if universal vouchers were adopted, (1) nonstate schools would arise to offer options to students currently trapped in poorly performing public schools; (2) parents would be aware of, and make use of, the options available to them; and (3) public school authorities would respond by reforming and improving school quality rather than using bureaucratic regulation to stifle effective challenge to their monopoly position.

Without actually adopting a universal voucher system it is impossible to determine how the market would respond were one to be implemented.[1] There is limited evidence suggesting that public schools do respond to increased competition by increasing quality.[2]

The fundamental difficulty in testing the assertions of voucher advocates in the U.S. has led to interest in establishing their impact in other countries.[3] Here the transition experience of the Czech Republic offers an ideal experiment. Below we analyze the rise of nonstate schools in the Czech Republic, the post-communist country where they have achieved the greatest influence during the past decade. We are, in general, not interested in events in the Czech Republic *per se*.

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[1] Downes and Greenstein (1996), Goldhaber (1999), and Figlio and Stone (2001) find that the location of and enrollment in private schools in the U.S. are heavily influenced by the quality of public schools in an area.

[2] Borland and Howsen (1992), Couch, Shughart and Williams (1993), Hoxby (1995), Arum (1996), Borland and Howsen (1996), Dee (1998), Brasington (2000), Marlow (2000), Greene (2001), and Grosskopf et. al. (2001) all find such an effect. Contrary results have been reported by Newmark (1995), Simon and Lovrich (1996) and Sander (1999).

[3] See, for example, Toma (1996), West (1997), Carnoy (1998), Mizala and Romaguera (2000), Angrist, et. al. (2001), and Chandler (2001).

but rather in what we can learn from these developments about the possible consequences were a major U.S. state to introduce a universal voucher system. With a population of about 10.3 million people and an area of just over 30,000 squares miles, one would do well to think of the Czech Republic as a close mirror of a major U.S. state such as Ohio. Local government consists of districts, with functions analogous to US counties. The country is an industrial democracy with an educated population. Although the legacies of communism create some unusual initial conditions, they also offer a unique opportunity to examine the responses of both public and private schools when an entire system is opened up to significant possibilities for competition at a single stroke.

Results are generally encouraging for voucher advocates. We find that private schools did arise, even in a period of substantial excess capacity among state schools. Moreover, they were more likely to arise where the state schools were doing a worse job in meeting their mission. Parents were aware of and responded to school quality. Finally, competition from private schools led to reforms in the public schools that increased their quality. On the negative side, however, there is evidence that the public school bureaucracy at least partially captured and redesigned the voucher system in order to preserve their privileged status.

II. The Czech Educational System[4]

Prior to 1989 education in the Czech Republic was, by law, a state monopoly. Schools were both a means of training workers, and a vehicle for political indoctrination. Very detailed curricula were prescribed by central authorities (Micklewright, 1999). Parental and student

[4]For more detail on the Czech educational system and reforms since 1989 see Filer and Münich (2001).

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preferences played little, if any, role in determining how much or what type of training was provided. Entry into coveted disciplines, while certainly influenced by ability, was also heavily determined by political or other considerations.

In such an environment it is not surprising that one of the first reforms during the transition was to provide greater flexibility and give more substantial decision-making power to parents and individual schools. A key reform was to allow nonstate[5] schools to challenge the state education monopoly. Table 1 shows the extent of nonstate education in various Central European countries by the middle of the first decade after the collapse of communism. Several trends stand out. In most countries, nonstate education has achieved only limited market share. In the Czech Republic, Slovakia and Hungary, however, the share of students in nonstate schools approached that in closely-related EU countries such as Germany and Austria.[6] It is not a coincidence that these three countries provide the most generous level of state funding for private and religious schools. In each, funding may be as much as 100 per cent of that provided to government schools.

The Czech educational system provides several paths that students can follow for secondary education. We focus on secondary education which began after either eight or nine years of primary education until 1996, when nine years of primary education was made

[5]We will use the term nonstate to refer to all types of education administered by non-government entities such as churches, foundations, profit making corporations and individuals.

[6]It lags considerably behind the EU average of almost 16%. This average is heavily influenced by very high nonstate enrollments in countries such as France, Belgium and the Netherlands where the tradition is for each of several antagonistic linguistic or religious groups to operate independent school systems with state funding.

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compulsory.[7] Students applied for various types of secondary school depending on their future career plans, with admission to over-subscribed programs rationed on the basis of exam performance and other considerations.

The lowest level of additional education available involves two years of vocational training.[8] Full high school education is divided into three types: vocational education leading to a certification exam, specialized secondary (technical) education in professional fields such as nursing and engineering, and general secondary education in academic high schools known as gymnázia. Students from all three types of secondary education may continue on to university, although it is rare for those from vocational school to do so and the majority of university students come from academic high schools.[9]

Although educational levels were on average relatively high, the structure of education is highly skewed towards vocational and away from general academic training. In 1989-90 fewer than one-quarter of secondary school students were enrolled in an academic, as opposed to a

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[7] Prior to 1996, students were allowed to apply for secondary education after eight years of primary school but could, particularly if they did not obtain their desired placement, remain in primary school for a ninth year. In the 1995/96 school year only about 5 percent remained in primary school for the ninth grade, down from about 20 per cent a few years earlier.

[8] Except for students who studied only for one more year before reaching the legal school-leaving age if they remained in primary schools for the full nine years possible.

[9] In order to enroll in university students must leave secondary school with an exam credential known as a maturita. Whether or not a student receives this credential, and can therefore continue on to university studies, depends on their program or course of study. In the Czech Republic, all gymnázia and 96 percent of technical school programs, but only 14 percent of vocational school programs, lead to a maturita and the possibility of university admission. In fact, many vocational schools are three years or less in length and cannot provide the maturita required for university admission. A market niche has arisen, therefore, for schools providing what is known as "addendum" programs to allow such students to qualify for university.

technical or vocational, program.[10] This percentage contrasts with slightly under half of secondary-level students in general academic programs in the average OECD country (OECD, 1997). By the end of decade, fewer than one in five upper secondary students in the Czech Republic were enrolled in general academic schools, the lowest proportion in any OECD member country (OECD, 2001). Furthermore, the technical and vocational education system is highly specialized. There are over 300 separate "tracks" in the Czech Republic, compared with 16 in Germany (Laporte and Schweitzer, 1994).

The legacy of the allocation system imposed by the planning authorities has resulted in substantial excess demand for various types of education (CEPR, 1998). In 1989 only 52 percent of those seeking university admission in the Czech Republic were offered at least one place. It is not possible to reconstruct from official data the success rate of students seeking admission to academic high schools.[11] It is widely understood, however, that many more students seek admission to these schools than there are places available. Similarly, places in popular fields in technical and vocational high schools, especially those required for the expanding service sector,

[10]Prior to approximately 1992, all academic high schools were four-year programs. With the freedom allowed after 1989, a number of gymnázia began admitting students after the fourth, fifth or sixth year of primary school. By the 1997/98 school year, these "extended gymnázia" accounted for over 40 percent of gymnázia students in the secondary-school (above grade 9) years. There has been considerable discussion about the impact of this reform on primary schools. It is generally assumed that the more talented and academically motivated students leave primary school for the extended gymnázia, resulting in less classroom stimulation and lower probability of academic success for those left behind. If this is true, then the trend will be self-reinforcing and the share of extended gymnázia should continue to grow over time. It should be noted, however, that this reform developed independently of the rise of nonstate schools. Indeed, the division between extended and conventional gymnázia is approximately the same in the state and nonstate sectors. Below we focus only on students in the secondary school part of extended gymnásia.

[11]Data is reported on the number of applications and the number of acceptances but not on the number of applicants.

were severely rationed during the 1990s. Thus, there should have been market niches that could be filled by entrepreneurial educational providers.

In addition, public schools in the Czech Republic have substantial weaknesses that may encourage parents to seek alternatives. In particular, the public school systems are overly focused on memorization rather than creative thinking (Tomášek et. al., 1997). Finally, some parents regard public schools with distrust, given their role in indoctrination under communism, a situation paralleling the attitudes of groups such as fundamentalist Christians in the U.S.

Development of the Czech educational system during the 1990s was driven by demographic trends as well as educational reforms. Table 2 shows the population at various ages in 1991 and 2000. It is clear that there were massive declines in birth rates during the final years of communism and early years of the transition. The number of children between 14 and 17 fell by over 200,000 to less than three-quarters of its 1991 level by the end of the decade. This demographic trend means that private schools were being created at a time of substantial excess capacity in the established public school system and makes their rapid increase in market share all the more remarkable.

Beyond establishing their legality, other major education reforms in the Czech Republic since the start of the transition have influenced the rise of nonstate schools. In particular, individual high schools, both public and private, were given legal status and decision-making authority over enrollment and curricula, enabling them to compete for students.

Table 3 shows the development of public spending over the decade. During the 1990s there were significant variations in public spending on education both in amount per student and in share of the Gross Domestic Product (GDP). Spending rose both in constant dollars and as a

share of GDP until the last years of the decade when it fell somewhat due to reduced cohort sizes and pressure on the state budget when economic growth slowed after 1997. Between 1991 and its peak in 1996, real spending per student increased by at least 37 percent. At the end of the decade it remained 16 percent higher than at the start of transition. The pattern of spending for secondary school students follows an exaggerated version of the same path, due to the fact that the peak spending year of 1996 coincided with an abnormally low number of secondary school students due to the addition of a ninth mandatory year of primary school that year. Filer and Hanousek (2000) have argued that inflation measures in transition economies contain substantial upward biases. If this is true, then real expenditures were substantially greater at the end of the decade than indicated in Table 3.

One of the most profound changes during the transition from communism has been a rapid and sustained increase in the value of education. Chase (1998), Filer, Jurajda and Plánovský (1999, 1998), and Münich, Svejnar and Terrell (1999) provide discussions of trends in returns to education in the Czech Republic. Table 4 shows the additional income that accrued to workers with various degrees beyond what would be earned by primary school graduates in the Czech workforce for selected years between 1984 and 1997.[12] Clearly the value of all types of education has been increasing, with the greatest increase occurring for workers with general academic or specialized technical education. The figures in Table 4 are for workers of all ages combined. Filer, Jurajda and Plánovský (1998) show that both levels of additional earnings and

[12]Although often called such in the literature, the results presented are not technically "returns to education" since they show only the private benefit of a given degree and ignore both social returns and the costs associated with that degree. Münich et al. (1999) show that these adjustments do not have a substantial impact in the Czech Republic.

the increase in these levels associated with various degrees are greater for younger workers, even though many of them were trained under the communist regime.

It would be surprising if individuals did not respond to such massive changes in private pecuniary returns. Indeed, Figure 1 shows that enrollment in secondary school as a fraction of the appropriate age cohort increased throughout the decade such that by 1999 enrollment was close to 100 percent among 14 to 17 year-old young men and women.[13] In addition, as can be seen in Figure 1, the increase in enrollments was greater in those types of schools where the increase in returns was greatest.

A similar pattern can be seen in the demand for university education. Figure 2 shows the fraction of each cohort applying to and enrolling in university, where the "cohort" is defined as those who turn 18 in a given year. Given the high rejection rate among applicants,[14] and the tendency for rejected applicants to reapply for several years, it is not appropriate, however, to infer that between 60 and 75 percent of eighteen-year-olds actually sought to go to university. It is also the case that the mean number of applications per applicant has been rising over time. In the Czech Republic the average number of applications per applicant increased from 1 (the limit allowed by the communists) in 1989 to 2.2 in 1992, after which it remained roughly constant at

[13]Determination of precise enrollment rates is complicated by the extension of primary school that occurred in 1996. We have omitted 14 year-olds from the relevant population in 1996 and later. The fact that there is no discontinuity in the trend line in Figure 1 at this point suggests that this is approximately the correct adjustment.

[14]In the mid-1990s roughly 80 percent of Czech gymnázium graduates, 37 percent of technical secondary school graduates and 22 percent of eligible vocational school graduates (i.e., the 8 to 10 percent of vocational school graduates who were enrolled in courses leading to the maturita) were successful in enrolling in university within two years of their graduation from secondary school. Obviously some graduates elect not to apply to university but overall places are still severely rationed.

2.45 or less for the remainder of the decade. Approximately 50 per cent of applicants seeking to go to university were admitted somewhere throughout the decade of the 1990s.

III. Growth of Nonstate Schools

The key reform of interest to us is the rise of private and church schools. Such schools were first legalized in the Czech Republic in 1990. Starting in 1992 they were funded from the state budget at a level that was at first equal to and then a substantial fraction of that provided to state schools through capitation grants based on enrolled students. In addition to public spending, those running private or church-sponsored schools generally obtain additional funding from other sources. Czech private schools generally charge tuition fees,[11] while church-sponsored schools, which are prohibited from charging such fees, are provided additional funds from congregational or diocesan resources for capital expenditures.

Despite their legality, there has been very little growth of nonstate primary schools in the Czech Republic. By the 1999/2000 school year there were only 51 private and church-related primary schools (1.3 percent of the total of 4,068 primary schools in the country), enrolling approximately 0.6 percent of all primary school pupils. Their role has been limited, frequently specializing in marginal students such as those needing special education or unable to adapt to normal school conditions. Experts suggest that the relatively minor role of nonstate primary schools may be due to their inability to attract a critical mass of students since the difficulty of

[11] In 1998 the mean annual tuition charged by nonstate gymnázia was approximately 15,000 Czech crowns ($450) with a range of from 1,500 crowns to 29,000 crowns. By way of reference, the mean annual wage during this year was approximately 150,000 crowns per worker while most households had at least two workers.

young children traveling long distances means that primary schools must be neighborhood-based.

At the secondary-school level the story is very different, with nonstate education playing a more important role. From a base of zero in 1990, nonstate secondary schools grew to approximately 25 percent of institutions by the middle of the 1990s. Since the average private or church-related school was significantly smaller than the average public school, however, around 13 percent of students were enrolled in nonstate secondary schools by 1995. Both the number of schools and the share of students enrolled in them appear to have leveled off by about the 1995/96 academic year and there has been little change since then.

Table 5 shows the number of state and nonstate secondary schools of various types between 1989/90 and 1999/2000. It is clear that, despite declines in the number of students in the relevant age range, there has not been a commensurate decrease in the number of secondary schools since educational reform began in 1990. Indeed, the total number of secondary schools increased by 42 percent from 1246 to 1764, down from a peak of 2116 in the 1995/96 school year.[10] Two-thirds of this increase was accounted for by nonstate schools, which grew from none to 401 institutions by the end of the decade (again down from a peak of 544 institutions three years earlier). One implication of this increase, combined with the decline in the number of students in the relevant age range seen in Table 2, is that the average school size fell precipitously over the decade. Even allowing for the fact that a greater share of secondary students have enrolled in academic high schools than in the past, the average state academic high school in the Czech Republic in 1999 was 12 percent smaller than a decade ago, while

[10]These figures exclude a small number of highly specialized schools such as dance and music academies.

enrollment in the average technical or vocational school shrank by over 40 percent.[17] This excess capacity, while creating a difficult environment in which to establish nonstate schools, also worked to their benefit. One key factor was to recognize that a school is not a building, but rather an organizational entity. Newly established private schools, therefore, were often able to rent space within buildings occupied by contracting public schools.[18]

Table 6 shows the total number of students in various types of schools over the decade. It is clear that both the fraction of teen-agers enrolled in school and the share of secondary school students in nonstate schools increased dramatically over the decade. Since the share of the cohort in state schools was approximately the same at the end of the decade as at its start, the increase in overall enrollment over the decade was almost entirely due to the rise of nonstate schools. It remains for further to investigate whether this increase in enrollments was because the rise of nonstate schools meant that students' preferences were being better served, discouraging early school leaving.

IV. Factors Influencing the Establishment of Nonstate Schools

We now turn to the question of the distribution of nonstate schools across space, first examining academic high schools (gymnázia) and then technical high schools. We will rely on district level data for much of our analysis. Studies of labor markets have found that there is

[17] This obviously raises questions of over-capacity and excess spending on fixed plant. Although there have been attempts to close unneeded public schools, given entrenched bureaucracies and reluctance to commute long distances these attempts have met with only limited success.

[18] This suggests an additional reason why nonstate schools were less likely to be established at the primary level. Schools at this level has much less autonomy than secondary schools, so individual school officials were not able to sign contracts to lease space and any revenues generated would have had to be returned to the state budget.

little commuting for employment across district boundaries, especially given the relatively small size of districts and the large differences in job opportunities (Erbenová, 1997). Mobility for employment was low during communism and has declined further since 1990 (Andrle, 1998). Whether due to intense localism or poor transportation infrastructure, it suggests that there is also likely to be little commuting to attend schools that are in some way more attractive than those nearby.

A. Academic High Schools

Table 7 shows the distribution of the number of state and nonstate gymnázia by district for 1992, 1995 and 1999. There is obviously considerable variation in the presence of nonstate gymnázia. Many districts have no nonstate alternative to the state academic high school(s). We are interested in what factors determine whether a nonstate gymnázium is founded in a given district. In particular, is it the case that such schools arise when the state alternative is, in some sense, less attractive?

It should be expected that nonstate gymnázia would be more likely to be established in areas where the local public gymnázia are of lower quality. Fortunately, unlike in many other studies where the quality of public schools is measured by inputs such as spending per student, we have a direct output measure based on the success of their graduates in obtaining admission to university. Recall that the primary purpose of gymnázia is to prepare students for university admission and that the vast majority of gymnázium graduates seek to go on to tertiary education, although many applications for admission are not successful. For each school in the Czech Republic data from the Ministry of Education enables us to calculate the success of applicants from that school in obtaining university admission measured as the ratio of *applications accepted*

to *applications filed* for students from the school. In addition, this measure weights each observation by the ratio of total applications to total admissions for the university in question, thereby placing more weight to the better (and, therefore, more highly demanded) universities. Although there are approximately two dozen universities in the Czech Republic, there are widely perceived quality differences among them. By general consensus, three institutions (Charles University and the Czech Technical University in Prague and Masaryk University in Brno) are regarded as significantly better than other alternatives and attract substantial excess demand every

year. The technical success measure is defined as:

$$z_j = \sum_i (k_i * x_{i,j} / y_j)$$

where k_i = applications/admissions for university i; $x_{i,j}$ = number of applicants admitted to university i from gymnázium j; and y_j = total number of applications to all universities from gymnázium j. The pattern of results reported below are not affected if we do not weight the observations or if we restrict the analysis to just the three top universities.

It is not appropriate, however, to measure the quality of a school solely by the raw success of its graduates in obtaining university admission. Some schools will start with more advantaged students who would have a high success rate even if the school is actually performing poorly. Other schools may be exceptional performers in that they produce high value-added even if the overall success rate of their students is not particularly high due to poor inputs (especially the quality of entering students). We therefore measure quality by a school's performance *relative* to how well it would be expected to do based on its environment. In the first stage we estimate a

school's success rate as a function of the share of the local population with at least a secondary school maturita-level education, share of the population living in towns (as opposed to villages), average class size in primary schools in the district (on the assumption that this will be reflected in the average quality of students arriving in the local gymnázia) and grade point average of applicants to the gymnázium from primary school (again to reflect quality of incoming students). For each public gymnázium we calculate the residual between the predicted and actual success in university admissions. We then average these school-specific residuals for all public gymnázia in a district weighted by enrollment and use this district average residual as a measure of public school quality in each local market.[19] We use this public school quality measure together with other explanatory variables in the second stage model of nonstate school entry.[20]

Table 8a reports descriptive statistics on explanatory variables considered in the first and second stage regressions. The first stage OLS regression results are presented in Table 8b. Success in obtaining admission to university among students in a given district is positively affected by the average education of adults in that district and the elementary school performance of the students. It is negatively affected by average class size in the district's primary schools and the degree of urbanization of the district.

The results of second stage probit regression are presented in Table 8c. The dependent

[19]Although derived independently, the methodology used to assess school quality is similar to that devised by NORC at the University of Chicago for a recent survey of high school quality in the US (*U.S. News*, 1999).

[20]There is one potential complication with our measure of university admission success. The number of applications per student, the quality of the schools to which a given student applies, or the fraction of students in a cohort who apply to university at all could be correlated with school quality if better school management motivates students to a greater extent. Application rates are so close to 1 among gymnázium graduates that we doubt the last of these is a problem. The first two, if a factor, should bias our results towards zero.

variable takes the value of one if a nonstate gymnázium was established in a district by 1995.[21] Several factors are associated with whether a nonstate gymnázium was established including the education level of the population (which should reflect both the preference for and ability to pay for academic education among parents), changes in high-school age cohort size, and unemployment rate. The positive relationship between a district's unemployment rate and the presence of a nonstate gymnázium may reflect dissatisfaction with the performance of the public school system if recent graduates from that system are having a hard time finding a job.[22] It may also reflect a shift in demand from technical or vocational education towards more general academic skills in the presence of economic uncertainty. Large declines in cohort size may be particularly relevant if they signal significant excess capacity in local public schools. We also include the number of students in non-academic high schools and the population density of the district. These are highly collinear so that either, but not both, is significant when included, although they are jointly significant. Obviously both serve as a measure of potential demand.

In addition to the factors reported in Table 8c, we analyze several other factors that might be related to the establishment of nonstate schools. These include the share of votes for the ruling coalition parties (on the grounds that regions that supported the government might have received favorable capital investment treatment in the public system), average wages in the district, the share of employment in agriculture, the distance from a major urban area (where universities are located), and the size of the largest town in the district without a public

[21] As we saw earlier, there has been little change in the extent of nonstate schools since 1995 in the Czech Republic.

[22] In the early years of the decade the overall unemployment rate in the Czech Republic was quite low, especially for a transition economy, averaging under 4 percent. Some districts, however, had unemployment rates that approached 10 percent. In recent years the overall rate has risen to slightly under 10 percent with the rate in some districts exceeding 20 percent.

gymnázium. None had a significant effect, so they have not been included in the estimates reported.[23]

As can be seen in Table 8c, all coefficients have reasonable signs. District education levels, potential student pool (jointly captured by population density and number of students enrolled in nonacademic secondary schools), and unemployment rate all increase the probability that a nonstate gymnázium is founded in a district, while a rapidly decreasing cohort size reduces that probability. Most importantly, the effect of public gymnázia quality on whether or not a nonstate gymnázium is established is significant and negative. If public schools in an area do better than expected in getting their graduates into university, it is less likely that nonstate competitors will emerge. Evaluated at mean levels, a one standard-deviation increase in the admission success of public gymnázia in a district results in approximately a one-third reduction in the probability of a nonstate gymnázium being established in that district.

There is an issue of simultaneity that might bias our results. The earliest data we have available for measuring admission success come from the 1995/96 academic year. Thus, we are using a measure of success *after* the establishment of nonstate schools to predict their establishment. While it would obviously be preferable to use admission success from 1992 or earlier, before there were a significant number of nonstate schools, it is likely that any biases introduced by the use of later data will work against the effect we see, thereby strengthening our results. We say this for two reasons. As we will discuss below, there is evidence that state gymnázia respond to the challenge of nonstate competition by improving quality. To the extent

[23]Results from a number of alternative specifications are available at:
http://195.113.12.52/munich/Research/Current1.htm

that such improvement had already taken place by the time we measured public-school quality, the quality differences between districts where nonstate schools came into existence and those where they did not should have been even greater at the time the nonstate schools were established. Furthermore, nonstate gymnázia typically draw from the lower end of the quality distribution among potential applicants. Such a finding casts doubt on the assertion that private school vouchers would result in cream skimming. It is, however, consistent with maximizing behavior. Top students in state schools can expect admission to leading universities in any case and so have little reason to pay the additional charges for private schools. It is the marginal students in poorer state schools who have the most to gain from attending private institutions. As a rough measure, the grade point average of elementary school students entering state gymnázia in 1995 was 1.30 (where 1 is the best grade and 5 is the worst), while the average for those entering nonstate gymnázia was 1.5. Thus, where nonstate gymnázia exist, there should be a selectivity effect increasing the average quality of students remaining in the public system, again serving to reduce cross-district differences in public school quality from the time when the nonstate schools were established.

B. Technical Schools

The role of secondary technical schools is quite different from that of gymnázia. Technical schools are expected to provide education that directly affects the labor market productivity of graduates, instead of preparing them for successful enrollment in university. The proportion of technical school graduates who apply to universities is much smaller than the proportion from gymnázia, while differences in the proportions admitted are even more pronounced. Thus, the admission rate to university is not a proper indicator of technical school

quality. Moreover, the curricula provided by technical schools is heterogeneous by definition. Although there have been some attempts to shrink the number of fields of study after 1989, hundreds of different curricula remain at the end of the 1990s.[24]

As discussed above, inter-regional labor force mobility in the Czech Republic is extremely low, with what mobility that exists arising mainly because of marriages. This implies that regions are, to a large extent, local markets and there should be a close relationship between the education provided and the prevailing industrial/occupational structure at the regional level. On the other hand, when disruptions due to the transition resulted in a mismatch between the educational institutions in a given region and that region's current labor market needs, there will be little possibility of resolving this mismatch through mobility of workers trained in other regions.

We would expect private technical schools to be more responsive than public ones to local labor market conditions and to arise when there are obvious niches to be filled in the demand for education. To test this hypothesis we consider a simple linear model

$$S^{t}_{j,d} = D_{j,d}\beta' + \varepsilon_{j,d}$$

where S represents an education supply indicator, D represents a vector of determinants of local demand for education, β is a vector of parameters, ε is a stochastic error term, and the subscripts j and d identify vocational branch and region. As in the case of gymnázia, public-school quality

[24]Personal conversations have revealed that there are approximately fifteen people at the Czech Ministry of Education, who each supervise a different set of vocational fields. The number of fields within a given general branch depends on the belief of the individual in charge of that branch, with new fields proposed by schools being approved or rejected based on personal opinion. This has resulted, for example, in many highly-specialized fields in the Electronics branch but few in the Engineering branch.

should be an important determinant of whether private schools arise. Since, however, we cannot rely on admission rates to universities, we focus instead on returns to education as the major determinant of school choice and demand for individual fields of study. Our hypothesis is that the likelihood that a private school with a given occupational specialization is established in a region depends positively on the relative scarcity of labor of a particular type in the region.

To obtain a proxy for the unmet demands of the market economy, we look at the growth in unexplained earnings (the residual from a standard Mincerian wage equation) between 1989 and 1996. The intuition is that occupation/location cells with a high growth in unexplained earnings are those in disequilibrium because of labor shortages.[25] The indicator is

$$\Delta w_{ij} = w^{96}_{ij} - w^{89}_{ij}$$

where w represents the average residual from an economy-wide log wage equation for individuals with secondary-school technical education (and the maturita exam) in a given region/occupation cell. This equation was estimated using a representative survey of approximately 3500 workers who were asked retrospective wage histories for the period 1989-1996 (see Münich et al. (1999), for a description of this data).[26] Averages are taken across 17 occupations and 8 regions including Prague.[27]

[25]We use residuals, rather than levels in order to account for the likelihood that even under communism unmeasured job characteristics resulted in higher wages for industries such as mining.

[26]The Czech Labor Force Survey does not collect wage information and there is no other data source such as household budget surveys or micro-censuses that provides information on wages for both the pre- and post-transition periods by branches.

[27]Educational data distinguish 31 occupational fields of study. These fields are not identical with occupational data from the retrospective survey. Therefore, for each two-digit occupational code we identified the closest matching educational field. We merged several fields if they fell within a single occupational group (examples include Architecture-Urbanism and Construction-

We would also expect the likelihood of a nonstate school being established to be greater in regions where there is significant unemployment, thereby indicating that current schools are not providing appropriate training. The local unemployment rate is therefore included on the right-hand side of our estimating equations, as well as dummies for Prague and for the Finance and Business field where we know *ex ante* that there were significant labor shortages.

Although we have 136 possible observations (17 fields times 8 regions), we are constrained by the number of observations available in the retrospective survey. For some cells we do not have a sufficient number of individuals to estimate reliable wage equations. We have excluded cells with fewer than 5 observations, leaving us 91 observation units. Increasing this threshold does not change the results.

We have examined two indicators of the responsiveness of private schools to labor market conditions. The first is the ratio of private school to public school enrollment in a given region and field of study, while the second is the ratio of nonstate school enrollment in a given region and field to total regional enrollment in technical schools, both private and public, across all fields. Finally, for comparison purposes, we examine the growth rate of public technical school enrollment in a given field/region cell to see if public schools also respond to labor market conditions.

Regression results for alternative supply of education indicators are presented in Table 9. Since many region/field cells do not have any private school enrollment, estimates for the extent

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Geodesy-Cartography, Health and Veterinary, Chemistry and Technical Chemistry, Trade and Law). We also excluded a few educational fields from our analysis when they were too divorced from market operations (such as theology) to estimate reliable wage equations.

of private school enrollment are of the truncated regression (TOBIT) form, while the growth in public school enrollment is estimated using ordinary least squares (OLS).

Results are quite clear. Both public and private technical schools have responded to market demands by increasing training in financial and business subjects. Here, however, the similarity ends. Nonstate schools have created opportunities for training in areas and fields where wages have been growing most rapidly, indicating increasing demand, and where unemployment rates are highest, indicating a greater regional mismatch of workers and jobs. Public technical schools, on the other hand, exhibit no such response to market conditions. In fact, the signs on the rate of wage growth and local unemployment rates are negative, although insignificant.

This pattern makes sense. As we saw earlier, returns to technical education increased the most during the post-communist period. It is likely that pre-existing state technical schools provided training better suited to the old industrial structure, thereby leaving gaps in the curricula demanded by employers in the emerging market economy. These gaps were filled by newly created nonstate schools which, unconstrained by past investments in physical and human capital, have concentrated in high-demand areas such as commerce, economics and hotel management. State schools, on the other hand, have not been able to keep up with shifting market demands, perhaps because they have less incentive to do so than nonstate alternatives. Thus, our results are consistent with recent reports that the unemployment rate of graduates from nonstate secondary schools is substantially lower than that of graduates from public schools (UIV, 2000).

V. Perception of nonstate schooling and parental school choice

Introduction of a large-scale voucher-like system requires public and political support. The opinions of the electorate, incumbent interest groups of teachers and school management, and parents of school-age children are, therefore, important. The actual behavior of parents considering placing their children in a nonstate school is, of course, a critical determinant of the success of the newly established nonstate schools and their ability to induce changes in the existing public schools.

To gain a better understanding of public awareness of nonstate school entry and competition we examined a representative sample of 1411 individuals surveyed in 1996.[28] The survey asked about family status, occupation, educational background, children, and schooling related opinions and preferences. Using these data we examine perceptions of nonstate schools among parents as well as factors influencing parents' actual school choice.

A. Perception of nonstate schooling

People responded to several statements about nonstate schools using a 4-point rating scale ranging from (1) strong disagreement to (4) strong agreement. Although answers are categorical, they are ordered. We, therefore, estimate an ordered logit model to identify key determinants of individuals' opinions.

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[28]The survey was conducted by Analysis Marketing Data (AMD) for the Institute for Information in Education (UIV). The survey does not provide detailed information on each child if there is more than one in a family. We exclude observations with missing values (mostly income). Dropping income from the estimating equations so that these observations can be included does not change the results.

Table 10 presents results of factors influencing opinions regarding private schools. Columns (2) through (4) deal with the statement: "Private schools serve as competitors to public schools, enhancing the quality of schooling." Combined results for both sexes are in column (2), results for males in column (3), and those for females in column (4). Overall, we find that public school teachers are more likely to disagree with the statement, reflecting their inherent biases and self-interest. Agreement is highest for individuals of about 50 years of age, by parents of school-aged children, and especially by parents of a child in a nonstate school who find local school choices satisfactory. Disagreement with the statement is more likely among parents who do not find local school choice satisfactory yet still have a child in such a school.[29] Higher income women are less likely to agree with this statement, perhaps reflecting the concentration of such individuals in Prague where public schools are better in general. Interestingly, education and being a teacher in a private school do not affect the opinion. No coefficient is significant in the men's equation while estimates for women are, of course, very similar to those in the aggregate model. This suggests that Czech men do not extensively participate in their children's education and schooling, leaving these decisions, as well as active involvement, to their wives. Given this difference, and the fact that coefficients for males were never significant, we present only results for women in analysing the remaining statements.

The second statement said: "Private schools are accessible mainly to the rich." As seen in column (5), only four factors are significant (at 10 per cent). Teachers in private schools are less likely to agree with this perception, suggesting that the general public may not have an accurate perception about the reality of (low) costs. Public school teachers are more likely to agree.

[29]Although we do not know the district of residence, it is likely that these parents live in districts where there is no effective private competition.

Younger individuals are also more likely to agree with this statement. Parents of students in a poor public school also may believe that they cannot afford private schools. Earnings and education, however, do not play a role in creating this perception.

The third statement, "Private schools are mostly of better quality than public ones," is analysed in column (6). Public school teachers' opinions serve their self-interest by disagreeing with this statement. As might be expected, parents who have opted to send their child to a private school even though they believe the local public school is good are especially likely to believe in the quality of the private school. More educated and higher earning parents are less likely to agree, again perhaps a Prague effect

Overall, it appears that the perception of the role of nonstate schools depends strongly on the amount of information and experience an individual has with the school system. Incumbent state-school teachers express a negative attitude towards nonstate schools, reflecting their vested interests. Conversely, those who work in nonstate schools are generally supportive. Parents, or at least mothers, appear to have reasonable and reliable opinions regarding the quality of local schools, but may overestimate the costs of alternatives.

B. Parental Choice of Schools

The second issue we look at is the decision to enroll a child in a nonstate school. The data possess some limitations because there are only 661 persons in our sample who have a child in either a grammar or upper secondary school.[21] To identify factors determining public/private school choice, we use a standard probit model, with results presented in Table 11. We find that teachers in public schools are less likely to place their child into a nonstate school. Parents with

[21] We also defined a smaller group of parents with children at secondary school only, but the results are not substantially different.

higher earnings and families with more education are more likely to choose a nonstate school. As dicussed above, a primary market for nonstate schools are students who are not admitted to local gymnázia. Educated parents are likely to be more upset if their child does not go to a gymnazium, and will, therefore be more likely to enroll him in a nonstate gymnazium whereas less educated parents will simply send the child to a vocational/apprentice school. The likelihood of a nonstate school choice declines at a diminishing rate with parental age until the mid-40's after which it increases. At the same time, 28 percent of respondents reporting a school age child are older than 43 years.[31]

VI. The Role of Nonstate Schools in Promoting Reform of State Schools

Finally, we turn to the issue of how state schools respond when confronted with competition from nonstate schools. Here our evidence comes only from the study of gymnázia due to a lack of data on other types of public schools. We divided the 77 districts into three groups according to the fraction of newly enrolled students entering nonstate gymnázia in 1995. Public gymnázia in 44 districts faced no competition from nonstate alternatives, while in another 7 districts newly established private gymnázia were of the extended format and enrolling students only in the lower grades in 1995. This left 26 districts where there was significant competition. These were further divided into two groups: those where less than an arbitrary 20 percent of new enrollees in gymnázia opted for nonstate schools and those where this percentage was greater than 20.[32]

[31]Other variables that were not significant include a dummy if person finds local choice of schools poor, municipality-size dummies, marital status.

[32]Nationwide approximately 12 percent of new entrants to gymnázia in 1995 enrolled in nonstate schools. Because there were no nonstate schools in the majority of districts, the percentage

Table 12 shows that there were substantial differences in how state schools behaved depending on the degree of competition they faced from private alternatives. Although the size of the cohort decline between 1992 and 1999 was similar across districts with differing degrees of nonstate competition, total enrollment in gymnásia remained almost constant when competition was extensive. More critically, despite a 16 per cent decline in enrollment, public gymnásia in districts where there was significant competition increased the number of classroom teachers by 22 percent and saw average class sizes fall by almost a third, a 50 percent greater drop than public gymnásia that did not face extensive competition where teaching staff remain almost constant and cohort declines resulted in average class size falling by a fifth. Recall that operating funding for schools is based on capitation grants and is not influenced by the degree of competition from local nonstate schools. Indeed, given that funds are a linear function of enrollment, the existence of fixed costs for administrators should mean that diversion of students to nonstate schools should result in increases in average class sizes. Since by far the largest component of costs is salaries (77 per cent of total costs in 1997), the marked reduction in class size suggests that schools facing competition must be reallocating resources away from administrative and other non-instructional personnel towards classroom teachers, real differences in behavior designed to make the public gymnázia more attractive. Finally, between 1996 and 1998 state gymnázia in districts where there was no private competition increased the number of personal computers per pupil by 533 percent while state gymnázia in districts facing the greatest competition increased the PC/pupil ratio by 683 percent.

Perhaps the greatest difference can be seen in what we have argued is the true test of the

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opting for such schools where they were available was significantly higher.

performance of gymnázia, success in gaining university admission for graduates. If we rank districts from 1 to 77 according to the success of graduates from their state gymnázia in obtaining university admission,[11] public gymnázia facing significant competition improved their relative rank by 4.5 positions between 1996 and 1998, while those facing moderate competition improved their ranking by an average of 0.6 positions. Given that there are a fixed number of districts, these improvements came at the expense of state gymnázia in districts where there was no competition from nonstate alternatives. State gymnázia in these districts saw their relative position deteriorate by an average of 1.4 positions. This result is not a statistical artifact created by the worst students leaving public gymnázia for private ones. If we include admissions for all graduates in a district combined, the improvement in performance when there is competition is even stronger. Combining state and nonstate schools, the typical district with strong competition improved its success in obtaining university admission for its graduates by 8.5 positions while districts with moderate competition improved by 6.5 positions. Districts without the spur of competition saw their relative rank decline by an average of 3.9 positions.

Unfortunately, there is also some evidence of efforts on the part of state school bureaucrats to capture the funding mechanism and reestablish their favored position. In a personal letter to Vaclav Klaus, the Czech Prime Minister when the structure of the Czech funding mechanism was being designed, Milton Friedman pointed out that to ensure effective school choice it was "important to examine the details and not only the titles of the proposals" in order to ensure that entrenched interests would be forced to provide real choice. The fate of private schools in the Czech Republic underlines how critical it is in ensuring effective

[11]As discussed above, success is measured as acceptances divided by applications weighted by the attractiveness of the universities to which students applied.

competition for funding of nonstate schools to be automatic and subject to the lowest possible level of interference from those with a vested interest in seeing alternatives to current arrangements fail. The impact of the efforts of vested interests to thwart the growth of competition may be seen in Tables 5 and 6, where the growth of nonstate schools came to an abrupt halt around 1996, with their share of schools and of students actually shrinking in the past few years. In large part this can be attributed to road-blocks created by administrators in the Czech Ministry of Education under the influence of lobbying from state schools. In the 1992 reforms, the per student funding level for nonstate schools was equal to that for state schools of the same type in the same area. Under pressure from education authorities, the principle of "equal treatment" for nonstate schools was abandoned in 1995, and the level of support for nonstate schools was set equal to 60 to 90 percent of the subsidy provided to state schools, with the exact amount being set by the Ministry of Education and regional school authorities on the basis of poorly specified performance criteria. This is exactly when the growth in nonstate schools halted, perhaps due to the need of such schools to increase tuition in order to offset reduced public support.

The complexity introduced by these reforms resulted in a lack of transparency and created uncertainty for operators of nonstate schools. The budget outlining Ministry of Education support for schools grew from 65 pages in 1992, the first year of the capitation system, to over 350 pages by 1999. The problems for nonstate schools that were inherent in this arbitrary process created dissatisfaction and resulted in the law being amended again in late1998, to take effect with the 1999-2000 school year. Currently, public support for private schools is based on a two-part formula. Base support at the level of 50 percent of total support for state schools is now

given according to the type of school and is independent of quality or ownership. There is then a supplement that varies according to quality as evaluated by district (county) level school offices (with final determination approved by a board at the Ministry of Education). Nonstate schools can obtain a maximum supplement equal to 90 percent of that available to state schools. In addition, the law now limits the discretion of the ministry and schools offices when evaluating quality to an explicit set of criteria. This policy was adopted in order to protect nonstate schools from arbitrary denial of funds by public officials.[14] Interestingly, 1999 was the first year for quite some time when the average tuition charged by private schools fell. It remains to be seen whether this will reverse the trend of declining importance of these schools during the previous three years.

VII. Summary and Conclusions

Post-communist Central Europe provides an interesting laboratory in which to investigate possible responses were a large U.S. state to adopt universal education vouchers. Although public schools were relatively good by objective standards, there was an initial surge in demand for private alternatives that eventually reached between 10 and 15 percent of the secondary school population. Private schools appear to have arisen in response to distinct market incentives. They are more common in fields where public school inertia has resulted in an under-supply of available slots. They are also more common where the public schools appear to be doing a worse job in their primary educational mission, as demonstrated by the success rate of academic high schools in obtaining admission to the top universities for their graduates.

[14]The difference in support is somewhat larger than these formulae would suggest since public schools are also eligible for capital funds for construction and maintenance from state sources. During the past decade such investment funds added about 10 percent to the level of support for state schools that was not available to nonstate institutions.

There is also evidence that public schools facing private competition do improve their performance. Public schools facing competition spend a larger fraction of their resources on classroom instruction and significantly reduce class sizes. Furthermore, Czech public academic high schools facing significant private competition in 1995 substantially improved their relative success in obtaining university admissions for their graduates between 1996 and 1998.

While generalizations must be made with caution due to the unique nature of the times during which private schools arose in the Czech Republic and the limited time over which to observe the responses of public schools, evidence from the adoption of the Czech nation-wide voucher scheme supports the claims of advocates for such systems. Private schools supported by vouchers increased educational opportunity and spurred public schools to improved performance. They also spurred public schools to engage in bureaucratic manoeuvring designed to preserve their entrenched position, pointing out how important it is that any system be simple and leave as little opportunity as possible for discretionary actions on the part of implementing officials.

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Table 1
Fraction of Primary and Secondary School Students in Nonstate Schools, 1996/97

Country	% in Nonstate Schools
Central Europe	
Bulgaria	0.5%
Czech Republic	5.0%
Estonia	1.3%
Latvia	0.7%
Lithuania	0.2%
Hungary	4.6%
Poland	2.0%
Romania	0.9%
Slovenia	0.4%
Slovakia	4.6%
EU Comparison Countries	
Austria	7.4%
Belgium	58.8%
France	20.6%
Germany	4.7%
Italy	5.7%
Netherlands	77.1%
United Kingdom	6.5%
EU Average	15.7%

Source: European Commission (1999)

Table 2
Age Structure of the Czech School-Aged Population
(thousands)

Age	7	8	9	10	11	12	13	14	15	16	17
# of Children 1991	133.9	134.5	138.6	141.1	150.4	168.0	174.0	177.2	182.0	187.0	188.6
# of Children 2000	120.2	120.9	128.7	127.9	126	129.9	128.3	130.7	133.5	134.2	134.7

Source: Czech Statistical Yearbooks, Various Years.

Table 3
Public Expenditures on Education

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Billions of 1989 crowns*	21.7	21.4	18.1	20.1	23.3	24.9	26	27.2	24.2	22.2	22.8
1989 Crowns per Student	8870	9050	7960	8990	10490	11100	11590	12190	10970	10260	10940
As Share of GDP	4.0%	4.1%	4.1%	4.5%	5.3%	5.3%	5.2%	5.2%	4.7%	4.4%	4.6%
1989 Crowns per Secondary School Student			8,30	9710	10580	12020	12780	16020	13460	12290	11700

Source: Authors' calculations based on Czech Statistical Yearbook, Various Years.

*The exchange rate has varied between 25 and 40 crowns to the dollar over the decade of the 1990s.

Table 4
Increased Earnings Compared to Primary School Graduates Over Time in the Czech Republic

Level of Education	1984	1993	1995	1997
Academic HS	15%	27%	35%	52%
Technical HS	20%	28%	45%	57%
Vocational HS	n.a.	n.a.	31%	37%
University	40%	60%	92%	125%

Figures for 1984 and 1993 calculated from Chase (1998)
Figures for 1995 and 1997 from Filer, Jurajda and Plánovský (1999)

Table 5
Czech Secondary Schools by Type, 1989-1999

		89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00
Academic												
	State	225	227	234	244	262	276	282	283	284	277	276
	Nonstate	0	2	24	41	62	72	79	84	82	79	67
Technical												
	State	375	390	564	575	598	677	711	668	653	626	604
	Nonstate	0	4	57	133	222	294	314	333	297	260	232
Vocational												
	State	646	671	663	669	643	638	625	611	574	508	483
	Nonstate	0	0	27	34	84	93	105	127	117	109	102
Total												
	State	1246	1288	1461	1488	1503	1591	1618	1562	1511	1411	1363
	Nonstate	0	6	108	208	368	459	498	544	496	448	401
	% Nonstate	0	0.5%	6.9%	12.3%	19.7%	22.4%	23.5%	25.8%	24.7%	24.1%	22.7%

Table 6
Enrollment in Czech Secondary Schools by Type, 1989-99
(thousands)

		89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00
Academic												
	State	100.7	101.8	95.9	89.9	80.5	76.6	77.1	66.8	66.4	68.4	72.3
	Nonstate	0	0.1	0.9	3.5	5.8	8.4	9.2	8.3	7.9	7.4	7.6
Technical												
	State	155.1	161.9	165	161.5	164.2	173.4	178.9	142	147.4	145.4	140.1
	Nonstate	0	0.2	3.3	10.1	20.5	32.3	37.4	31.5	29	23.5	20.1
Vocational												
	State	310.2	301.8	277.4	248.8	237.6	231.9	211.1	139.8	122.4	111	145.4
	Nonstate	0	0	0	17.2	27	24.3	23.4	15.9	12.7	11.5	14.6
Total												
	State	566	565.5	538.3	500.2	482.3	481.9	467.1	348.6	336.2	324.8	357.8
	Nonstate	0	0.3	4.2	30.8	53.3	65	70	55.7	49.6	42.4	42.3
	% Nonstate	0	0	0.7%	5.8%	10.0%	11.9%	13.0%	13.8%	12.9%	11.5%	10.6%

Table 7
Distribution of the Number of Academic High Schools by District
Czech Republic

Number of Gymnázia in a District	Number of districts with given number of gymnázia					
	1992	1992	1995	1995	1999	1999
	State	Nonstate	State	Nonstate	State	Nonstate
0	2	59	1	44	1	45
1	5	12	5	16	6	20
2	29	2	23	11	24	9
3	22	2	21	2	23	0
4	11	0	13	1	8	1
5	2	0	6	0	7	0
6	2	1	2	0	4	0
7	1	0	2	0	1	0
8	2	0	0	0	0	0
9	0	0	1	1	1	0
10 or More	1	1	2	1	2	2
Total	77	77	77	77	77	77

Table 8a
Descriptive statistics

1st stage	mean	std.dev.	min	max
Edu23	0.30	0.080	0.21	0.47
Townpop	0.71	0.199	0.34	1.00
Pclass	23.02	1.054	20.09	24.02
Agrade	1.30	0.138	1.06	1.90
Prague	0.13	0.338	0	1
2nd stage				
Edu3	0.06	0.021	0.03	0.16
DelCohort	1.35	0.087	1.17	1.57
Dens	210.30	392.83	36.00	2451.10
Non-Gym	2036.59	1814.72	614	15984
Unemp	0.04	0.02	0.003	0.08
Q	-1.73	13.36	-30.96	33.40

1st STAGE: Estimating district level public schools' quality

Agrade	Grade average of applicants to Gymnazia from Primary school. A measure similar to elem. 1<=agrade<5; 1 is the best and 5 the worst.
Pclass	Pupils/class district ratio in Primary school in district
Edu23	Share of population with at least full-secondary education
Townpop	Share of population living in towns
Prague	Dummy if Prague

2nd STAGE: Estimates of nonstate school entry (probit)

Dens	District population density
Non-Gym	Number of students in technical and vocational high schools in 1991
DelCohort	Percentage decline in high school aged cohort between 1992 and 1994
Edu3	Share of district population with university education
Unemp	District unemployment rate
Q	Public schools' quality

Table 8b
1st stage estimates of school graduates' quality regression

	Coef.	Std. Err.	t-stat
Edu23	3.33	0.45	7.32
Townpop	-0.38	0.12	3.19
Pclass	-0.91	0.55	-1.66
Agrade	-0.42	0.13	-3.19
Prague	-0.63	0.08	8.03
Const	2.13	0.71	3
Nobs		***219***	
$AdjR^2$		***0.32***	

Table 8c
Probit Estimates of the Probability of a
Nonstate Gymnázium in a District by 1995

	dF/dx	Std.Err.	z
Edu3	21.18	8.74	2.46
DelCohort	-1.95	0.93	2.07
Dens	0.002	0.001	1.25
Non-Gym	0.0001	0.0002	0.76
Unemp	10.24	4.79	2.19
Q	-1.12	0.58	1.91
Nobs		***76***	
pseudo R^2		***0.29***	

Table 9
Determinants of Vocational School Enrollment, 1996
(standard errors in parentheses)

	Private Enrollment/ Public Enrollment (Within Cell)	Private Enrollment (Within Cell)/ Total Enrollment	Increase in Public Enrollment (1991-1996)
Increase in Wage Residual	.193***	.042***	-.121
	(.067)	(.015)	(.330)
Unemployment Rate	.104**	.015*	-.117
	(.045)	(.009)	(.189)
Prague	.358***	.055***	-.489
	(.105)	(.021)	(.444)
Finance & Business	.618***	.202***	.759**
	(.050)	(.012)	(.307)
Constant	-.212***	-.041***	.198
	(.065)	(.013)	(.242)
Estimation Method	Tobit	Tobit	OLS

***Significant at 1% level
**Significant at 5% level
*Significant at 10% level

Table 10
Determinants of Perceptions About Nonstate Schools

	Statement No.*					
	1 Total	1 Males	1 Females	2 Females	3 Females	Definition of variables
TEACHER	-0.399	-0.192	-0.505	0.021	-0.788	dummy=1 if teacher, 0 otherwise
	-0.072	*-0.603*	*-0.073*	*-0.075*	*-0.006*	
TEACH_PR	1.083	-	1.156	-2.324	1.513	dummy=1 if teacher in nonstate school, 0 otherwise
	-0.286	-	*-0.254*	*-0.007*	*-0.122*	
EXP_BAD	-0.295	0.051	-0.479	0.138	0.087	dummy=1 if child in state school and poor local school choice
	-0.163	*-0.886*	*-0.069*	*-0.069*	*-0.748*	
EXP_GOOD	1.899	33.102	1.501	-0.527	1.851	dummy=1 if child in nonstate school and good local school choice
	-0.009	*-0.999*	*-0.052*	*-0.506*	*-0.007*	
INFORMED	0.318	0.232	0.336	-0.302	-0.014	dummy=1 if school age child present
	-0.021	*-0.278*	*-0.065*	*-0.11*	*-0.943*	
EDU	-0.028	-0.041	-0.018	-0.047	-0.131	years of education
	-0.321	*-0.322*	*-0.641*	*-0.236*	*-0.001*	
AGE	-0.052	-0.043	-0.059	0.099	-0.012	years of age
	-0.05	*-0.285*	*-0.101*	*-0.011*	*-0.74*	
AGE2	0.512	0.444	0.553	-0.878	0.094	age squared /1000
	-0.078	*-0.309*	*-0.158*	*-0.04*	*-0.818*	
GENDER	2.022	-	-	-	-	dummy=1 if female
	-0.319	-	-	-	-	
LEARN_M	-0.026	-0.033	-	-	-	log(monthly earnings) of primary male in household
	-0.892	*-0.886*	-	-	-	
LEARN_W	-0.292	-	-0.283	-0.027	-0.387	log(monthly earnings) of primary woman in household
	-0.066	-	*-0.089*	*-0.873*	*-0.021*	
Pseudo R2	***0.0124***	***0.0085***	***0.0156***	***0.025***	***0.045***	
Nobs	***1142***	***483***	***659***	***673***	***653***	

p-values in parentheses

*Statement No.1: "Private schools serve as competitors to public schools, enhancing quality of schooling."
Statement No.2: "Private schools are accessible mainly to the rich"
Statement No.3: "Private schools are mostly of better quality than public ones."
Answers: ranging from (1) strong disagreement to (4) strong agreement

Table 11
Determinants of Choice of Nonstate Schooling

	dF/dx	Definition of variables
	(p-value)	Dependent variable: Child in nonstate state school : 1 0
TEACHER	-0.027	Dummy=1 if teacher, 0 otherwise
	(0.063)	
TEACH_PR	0.225	Dummy=1 if teacher in nonstate school, 0 otherwise
	(0.080)	
AGE	-0.014	Years of age
	(0.069)	
AGE2*1000	0.164	age squared *1000
	(0.071)	
LEARN	0.030	log(monthly earnings)
	(0.024)	
EDUMAX	0.009	Maximum parental years of education
	(0.009)	
obs. P	***0.038***	
pred. P	***0.024***	
Pseudo R2	***0.136***	
Nobs	***474***	

p-values in parentheses, p > z are the test of the underlying coefficient being 0.
dF/dx is for discrete change of dummy variable from 0 to 1

Table 12
Changes in Public School Inputs and Quality
According to Degree of Competition by 1995

	Little or No Competition	Moderate Competition	Extensive Competition
Percentage decline in population aged 14 to 17 (1992-1999)	-24.9%	-22.6%	-26.2%
Percentage decline in population aged 14 to 17 (1995-1999)	-14.0%	-13.0%	-16.8%
Percentage change in students in gymnásia (1992-1999)	-19.6%	-19.8%	-4.6%
Percentage change in students in gymnásia (1995 - 1999)	-4.4%	-15.2%	-6.9%
Percentage change in students in public gymnásia (1992-1999)	-20.3%	-24.0%	-15.9%
Percentage change in students in public gymnásia (1995-1999)	-5.1%	-15.1%	-2.4%
Percentage change in teachers in public gymnásia (1992-1999)	+1.0%	-4.3%	+21.8%
Percentage change in teachers in public gymnásia (1995-1999)	-5.5%	-16.6%	-1.0%
Percentage change in public student/teacher ratio (1992-1999)	-21.2%	-20.6%	-31.0%
Percentage change in public student/teacher ratio (1995-1999)	+0.4%	+1.8%	-1.4%
Percentage increase in personal computers per pupil (1996-1998) (1998 mean PC/Pupil ratio)	533% (0.27)	453% (0.22)	683% (0.28)
Relative success in obtaining admission to university (1 = best, 77 = worst) Public Schools Only	+1.4	-0.6	-4.5
Relative success in obtaining admission to university (1 = best, 77 = worst) All Schools Combined	+3.9	-6.5	-8.5
Number of districts	51	11	15